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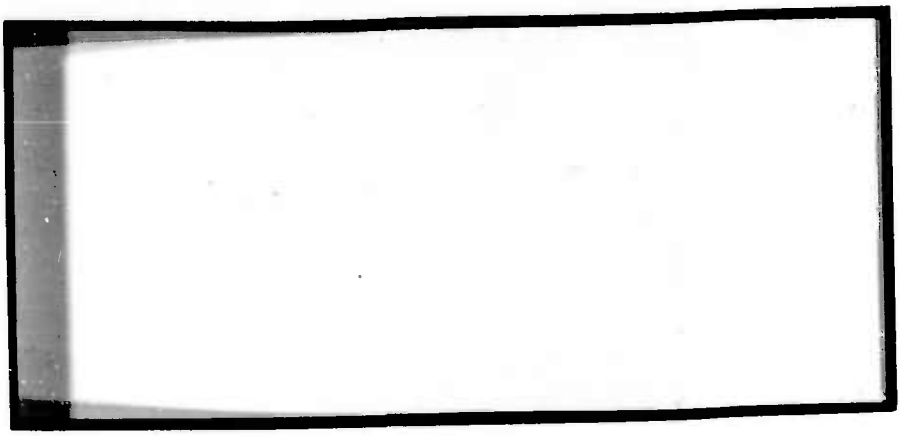

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Special Report 20

OBSERVATIONS ON PROJECT LAKE HAZEN

Report prepared for Northeast Air Command, U. S. Air Force

by

James A. Bender

Chief, Snow and Ice Basic Research Branch

May 1956

SNOW ICE AND PERMAFROST RESEARCH ESTABLISHMENT
Corps of Engineers, U. S. Army
1215 Washington Avenue
Wilmette, Illinois

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AUTHORITY

Operations order serial no. 5-56, Headquarters, Northeast Air Command, APO 862, New York, New York, 15 March 1956 (CONFIDENTIAL) established project LAKE HAZEN and gave it the following mission:

"To determine suitable areas on sea ice and/or frozen lakes in polar regions that are capable of supporting the operation of heavy aircraft (100,000 to 200,000 pounds) and conducting the wheel landing tests of C-54, KC-97, and B-47 type aircraft."

The Snow Ice and Permafrost Research Establishment representative determined the bearing strength of the ice and the snow properties.

PARTICIPANTS

Lt. Col. Robert Wilson, USAF, NEAC Hqs. — Project Leader

Wing/Commander Fred Craig, RCAF, Air Force Hqs. Ottawa — Canadian Observer

Mr. David Barnes, AFCRC — Geophysicist

Mr. James Bender, SIPRE — Physicist

The operational orders included a participant from Strategic Air Command and it is to be considered unfortunate that such a person was not present.

CHRONOLOGY - 1956

3-5 April: Participants gathered at NEAC Headquarters and finalized the planning.

5-7 April: Participants traveled to Thule AB, Greenland.

8 April: Lt. Col. Wilson and Mr. Bender made a survey of North Star Bay (Thule Harbor).

9-10 April: Equipment and supplies were assembled for the Lake Hazen trip.

10 April: Mr. Bender was an observer on a C-54 flight over northern Greenland looking for T-2 Ice Island.

11-15 April: Party landed at Lake Hazen, made survey, and returned to Thule AB.

17 April: Participants started to return to their respective headquarters.

NORTH STAR BAY (THULE HARBOR)

A survey was made on a line starting from Mount Dundas and proceeding toward Saunder Island. Ice and snow measurements were made every 0.2 mile. The data are shown in Table I. As there was only a shallow snow cover, it was possible to make the survey using a jeep.

Table I

Distance from Dundas (miles)	Ice Thickness (in.)	Snow Ice Temp (°F)	Snow Depth (in.)	Snow Characteristics
0.5	40	12	6	3 in. hard snow, 3 in. depth hoar
0.7	43	11	3	3 in. hard snow
0.9	46	12	$3\frac{1}{2}$	$3\frac{1}{2}$ in. hard snow
1.1	$40\frac{1}{2}$	10	$2\frac{1}{2}$	$2\frac{1}{2}$ in. hard snow
	$27\frac{1}{2}$*	13	5	3 in. soft snow, 2 in. depth hoar
1.3	$37\frac{1}{2}$	16	9	4 in. hard snow, 5 in. depth hoar
	$47\frac{1}{2}$	9	$2\frac{1}{2}$	$2\frac{1}{2}$ in. hard snow
1.5	$42\frac{1}{2}$	12	5	5 in. hard snow

The density of the snow varied from 0.2-0.3 g/cm^3 for the depth hoar to 0.4 for the hard wind-packed snow. Rammsonde readings varied from values of 19 to [illegible].

Capabilities

The conditions as noted on 8 April 1956, if care is taken to avoid the healed cracks, would allow the following:**

(1) Regular operation on unprepared ice surfaces of C-47, C-54, and C-119 type aircraft.

(2) Emergency operation of KC-97, C-124, and B-47 type aircraft, although the landing of a B-47 would be considered rather hazardous on the unprepared surface because of the high landing speed and the relatively unstable landing gear configuration for rough surfaces.

Recommendations

In order to fully utilize the capabilities of the ice, an area of the bay ice should be cleared of snow each winter and kept cleared, and weekly ice surveys should be made. This would provide the following:

* This was a healed crack 30 in. wide, originating from Dundas and extending southeast across the bay.

** For additional general information see SIPRE Report 36, Airfields on floating ice sheets (1956).

a. increase in ice thickness (and consequently increase in bearing capacity) due to the removal of the insulating layer of snow;

b. the availability of an emergency landing strip for aircraft developing trouble immediately after take-off. It is thought that, if such a strip had been available in 1955, the crash and loss of a C-124 shortly after take-off could have been avoided;

c. the availability of an airstrip if the main Thule strip should be out of commission.

SEARCH FOR T-2 ICE ISLAND

An ice island that may have been T-2 had been observed on radar near 82° 25'N and 54° 30'W a few weeks earlier. On the return of a regular C-54 resupply flight from NORD, a search was made for the island over the northeast coast of Greenland on a line from NORD to Alert. Visibility was very good, but no ice island corresponding to T-2 was sighted.

LAKE HAZEN

Lake Hazen is a fresh water lake approximately 45 miles long and 10 miles across at its widest (see Fig. 1). It has a total area of over 350 square miles. Although mountains of the Garfield and United States Range tower over the lake from the north and northwest, the remainder of the land surrounding it is comparatively low, which makes for unusually good approach conditions. The important strategic location of the lake is easily recognized when viewed on a top of the world projection, as shown in Figure 2.

On 27 April 1955, personnel of the Northeast Air Command, accompanied by representatives of the Defence Research Board (Canada), the U. S. Hydrographic Office, and SIPRE, carried out a survey of Lake Hazen in a ski-wheel C-47, remaining down for about 2 hours.

On 11-15 April 1956, a party was landed and camped there for $4\frac{1}{2}$ days (camp site shown by triangle). The observations and measurements are shown in Tables II and III, along with data previously taken; the positions where measurements were taken are shown on Figure 1. Two examples of the snow conditions are shown diagrammatically in Figure 3. In all of the current cases, there was evidence indicating that the top portion of the ice was old ice that had not melted during the summer of 1955. This is different from the conditions of the previous year, when only new ice was found. The difference is due to the fact that the summer of 1954 was abnormally warm and the summer of 1955 on the cool side. This may also explain in part the difference in the amount of snow cover in the two years. A 1-x 1-x 1-ft ice section was removed from the lake and the crystallographic features will be examined in detail at the SIPRE laboratory in Wilmette, Illinois.

Table II

Date	Local Time	Air Temperature (°F)
11 April 1956	1800	-25
	2300	-30
12 April 1956	1400	-27
	1700	-28
	2400	-39
13 April 1956	1100	-29
	1400	-24
	1800	-26
	2400	-28
14 April 1956	0930	-24
	1100	-18
	1300	-20
	1900	-21
	2130	-20
15 April 1956	1400	-10
	1800	-15
27 April 1955	—	- 2

Table III

Position*	Ice Thickness (in.)	Snow Depth (in.)	Water Depth (ft)
1	72	$11\frac{1}{2}$	—
2	73	$10\frac{1}{2}$	—
3	72	10	8
4	71	$9\frac{1}{2}$, 13, $8\frac{1}{2}$	—
5	73	9 - 11	590
6a	72	2 - 20	615
7b	48 - 60	—	—
8c	96	—	8
9d	120	12	—

* See Fig. 1.

a. Northeast Air Command — Report of investigations of snow cover and ice thickness at Lake Hazen.
Date of Observation: April 27, 1955.

b. Shackleton — Arctic journeys.
Date of Observation: April 24, 1935.

c. MacMillan — Four years in the white North.
Date of Observation: May 22, 1915.

d. Greely — Three years of arctic service.
Date of Observation: April 30 - May 2, 1882.

Capabilities

The ice found on 11-15 April 1956 would support aircraft weighing up to 500,000 lbs. This means that even the heaviest of the U. S. bombers (B-36 and B-52) could use this immense natural landing field.

Because of the amount and condition of snow cover, landing of wheeled aircraft on uncleared areas would not be recommended. Although the snow was only about 10 in. thick, the alternate pattern of hard, wind-packed snow with soft, cohesionless snow would make it dangerous for wheeled aircraft.

However, the fact that a cleared runway would be necessary is no longer considered to be a deterrent (in 1955 the snow cover was only about 2 in.). There are available several types of small, high-efficiency snow-removal machines which are jeep-mounted, e.g. Rolba Type II, manufactured in Switzerland. One machine of this type could clear a 200 x 10,000 ft area of the observed snow conditions in 40 hr — 2 machines in 20 hr. These machines could be brought in by ski-wheel C-47's, or paradropped, and only need one operator each.

The hours of daylight at a latitude of 82°N are shown in Figure 4.

Based only on a limited amount of meteorological data from the Joint Arctic Weather Stations, the projected operating periods for various type aircraft are shown in Table IV.

Table IV.

Type of Aircraft	Projected Operating Period
C-47	15 Oct* through 30 June
C-54. C-119	1 Nov through 15 June
C-124, KC-97, B-47	1 Dec through 1 June
B-36	1 Jan through 20 May
B-52	10 Feb through 10 May

It should be emphasized that no actual landings of heavy aircraft should be attempted until an actual prior reconnaissance has been made by a competent observer.

Potentialities as a Spartan refueling base

Technical advances and experiences in the past few years have exploded the myth of not being able to operate in the Arctic, as evidenced by such operations as Thule AB, Greenland Ice Cap stations, compacted snow runways, and the DEW-line. Lake Hazen would be ideal as a refueling station.

Rubberized collapsible fuel tanks or reinforced plastic sectionalized tanks could easily be brought into the area and placed on shore or on one of the islands. Johns Island has cliffs over 60 ft high and would be ideal for use in a gravity flow system.

* Because of the uncertainty of this date, ski landings could perhaps be made along the shore if there is a snow cover, and then the ice tested.

An airstrip could be cleared and ready for operation in one to two days. With 350 sq miles of potential runway, it would be very easy to disperse aircraft.

The ice surface was extremely level (no cracks observed) and the top, old rough ice layer provides a good braking surface.

The lake is a natural radar target and small passive radar reflectors could mark the actual runway.

Two Jamesway huts could be erected for emergency conditions and perhaps a Butler building to house two snow plows.

Recommendations

The ability of Lake Hazen to support the heaviest type of aircraft (as noted on 11-15 April 1956), its strategic location, huge size, and good approach conditions are to be considered as established facts.

From a limited amount of information, the estimated snow removal effort and a projected operating period for various type aircraft have been given.

The meteorological conditions, the snow conditions, and the bearing capacity of Lake Hazen the year around are less well known. Such information is necessary if the potentialities of the lake are to be fully exploited. In many years, the effort required to clear a runway will be much less, and the operating periods for various aircraft much longer than shown in this report. The following recommendations are made to supply the required information.

1. Weekly observation flights should be made over the area during August to determine the time of break-up (if any). Flights should be made on 3, 10, 17, and 24 September (or the next clear day) to observe freeze-up time. The projected operating period can be more accurately computed when the freeze-up date for the season is known.

2. A portable automatic weather-collecting station should be installed on Johns Island in late October.

3. Periodic landings should be made in the area to service the weather station, to observe snow conditions, and to measure ice thickness (6 ft of ice can be drilled and measured in 10 min with the SIPRE 1-in. ice drill). Such investigations could be combined with the supply flights to Eureka and Alert.

4. Erection of a well stocked Jamesway or similar shelter on Johns Island would facilitate future investigations.

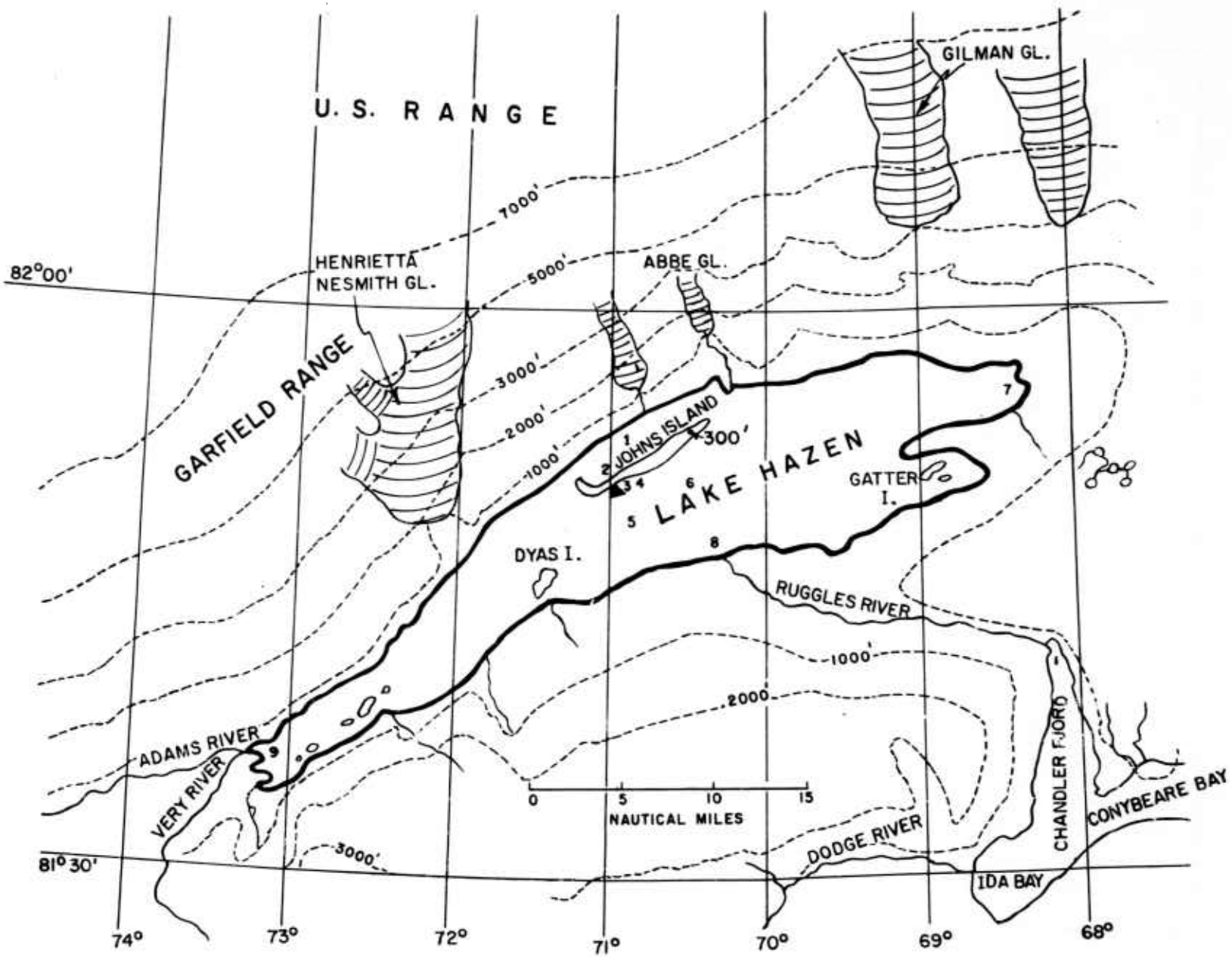

Figure 1. Lake Hazen

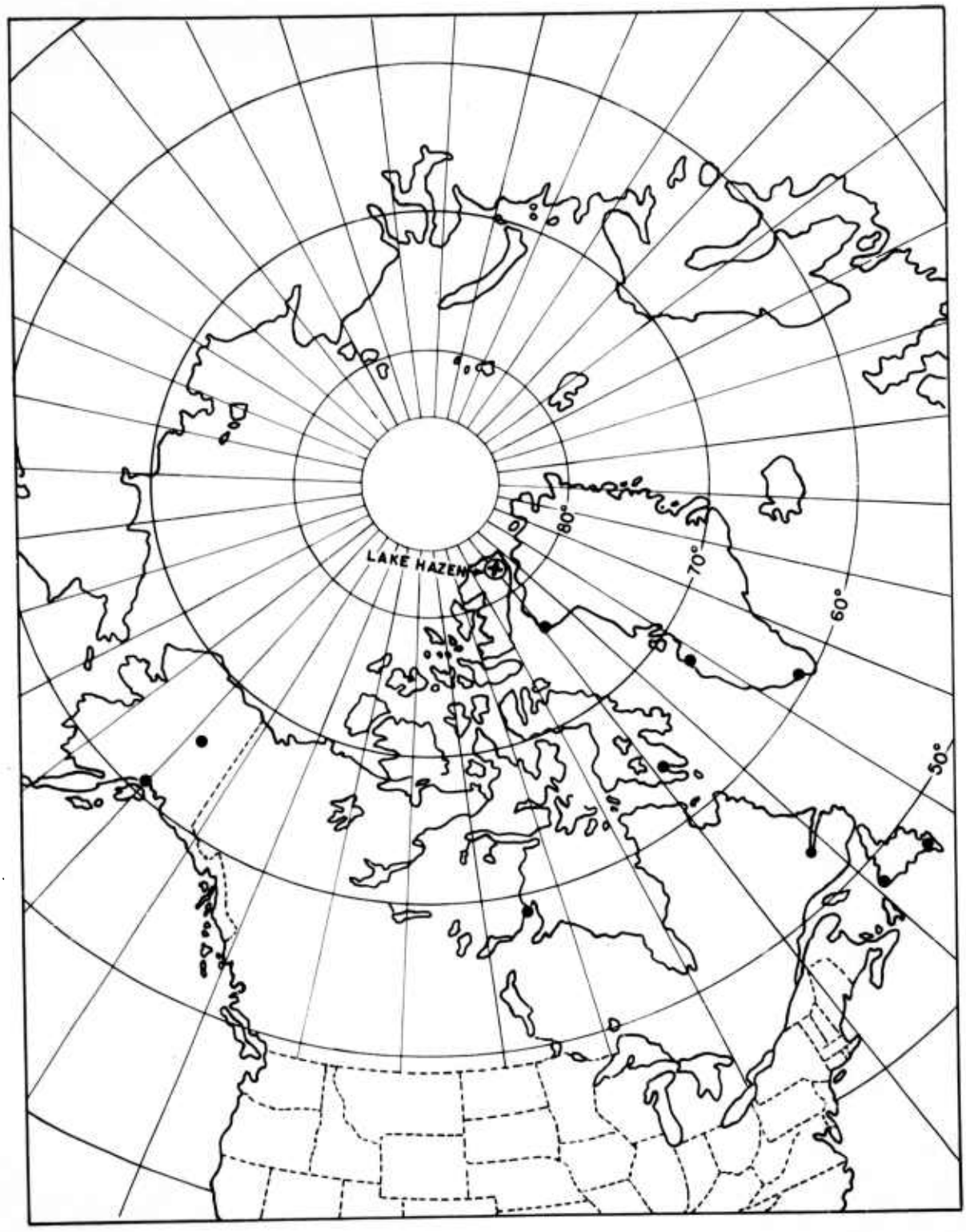

Figure 2. Top of the world projection.

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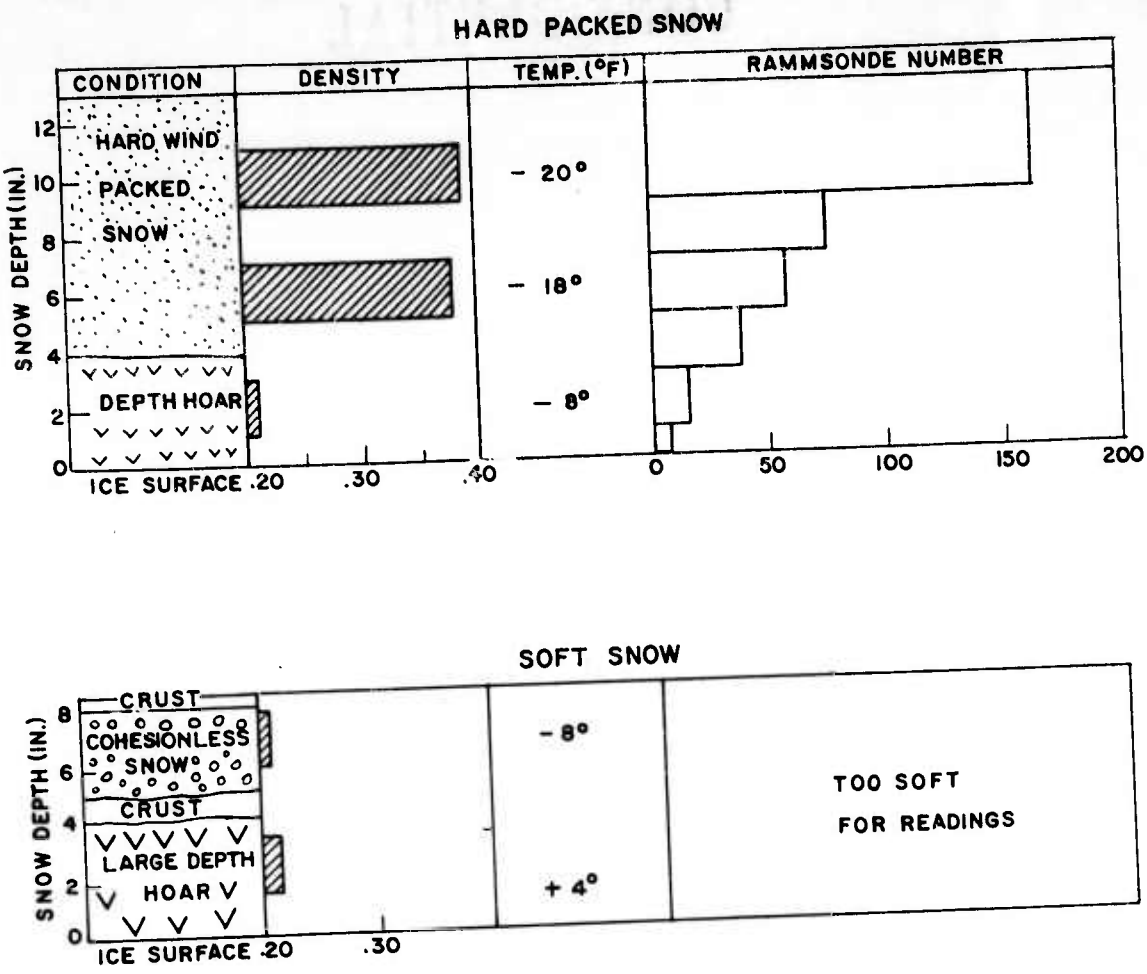

Figure 3. Snow conditions on Lake Hazen, 13 April, 1956.

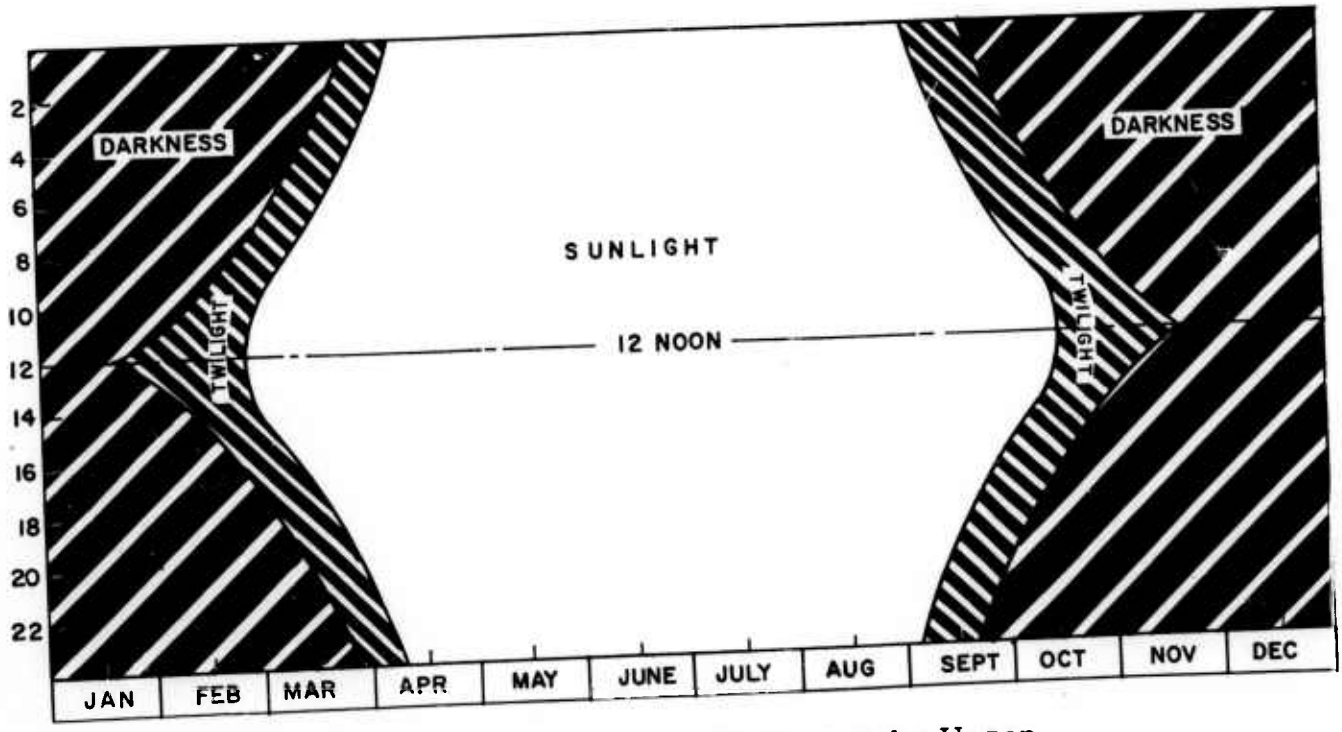

Figure 4. Hours of sunlight at Lake Hazen.

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